Citation:

Rastogi T, Reddy KS, Vaz M, Spiegelman D, Prabhakaran D, Willett WC, Stampfer MJ, Ascherio A. Diet and risk of ischemic heart disease in India. *Am J Clin Nutr*. 2004 Apr; 79(4): 582-592. PMID: 15051601

Study Design:

Case-control.

Class:

C - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To assess the relationship between diet and ischemic heart disease (IHD) in Indians.

Inclusion Criteria:

Between the ages of 21 and 74 years.

Patients who were hospitalized with a diagnosis of first incident acute myocardial infarction (MI) between January 15, 1999 and January 16, 2000 in eight urban hospitals of New Delhi or Bangalore, India.

Exclusion Criteria:

- Previous history of MI or IHD (including bypass surgery, angina or stroke)
- Pregnancy, history of cancer or chronic disease of the kidney, liver, gastrointestinal tract or thyroid
- Acute viral infection in the four weeks before admission.

Description of Study Protocol:

Recruitment

Patients hospitalized with MI for cases. Controls were obtained from non-cardiac outpatient clinics or inpatient wards.

Design

Case-control.

Statistical Analysis

IHD risk factors were compared between cases and controls by T-tests for matched data, signed-rank tests for continuous variables and chi-square tests for categorical variables. To assess

the potential for confounding, mean values or the prevalence of IHD risk factors across food group intake categories among controls were examined. The relation between intakes of vegetables, trans fatty acids, and mustard oil and IHD risk was examined by conditional logistic regression. Analyses of food groups compared persons in increasing categories of intake with persons in the lowest category. The relation between types of fats or oils used in cooking and frying and IHD risk was also assessed in conditional logistic regression analysis with the reference group being users of sunflower oil. Risk according to use of ghee, vanaspati, mustard oil, peanut oil, sunflower oil or safflower oils was assessed categorically, and a Bonferroni correction was used to adjust for multiple comparisons in which only P values less than 0.01 were considered to be statistically significant. Analyses were conducted by Statistical Analysis Software v. 8.

Data Collection Summary:

Timing of Measurements

At two to five days after admission for cases and at clinic visits for controls.

Dependent Variables

- Socioeconomic status; smoking history; history of hypertension, diabetes and hypercholesterolemia; family history of cardiovascular disease; dietary intake; types of fat or oils used in cooking; nutritional supplement use and physical activity by interview
- Anthropometric measures (height, weight and hip and waist circumferences) to determine body mass index (BMI) and waist-hip ratio. Waist and hip were measured using a standardized tape measure with waist taken at the midpoint between the costal margin and ileac crest and hip measures at the widest circumference.
- Food-frequency questionnaires (FFQ) were used to obtain a measure of long-term dietary intake. It followed the format of the Harvard FFQ except that the response categories were open-ended. There was a separate FFQ for New Delhi and Bangalore because of the regional differences in food intake.
- Physical activity was assessed using a validated questionnaire specific for the Indian population that focused on occupational and other non-leisure-time and leisure time activities. It was validated by comparing energy expenditure (from the FFQ) with energy intake as measured by 24-hour dietary recalls. Metabolic equivalent-minutes (MET-min), a measure of intensity and duration of specific activities, were also derived.

Independent Variables

Acute MI based on clinical examination, electrocardiogram readings and measurement of cardiac enzymes.

Control Variables

Relatively healthy individuals with minor ailments or conditions.

Description of Actual Data Sample:

- *Initial N:* 419 cases, 707 controls
- *Attrition (final N):* 350 cases, 700 controls (12% women)
- *Cases:* 25 died, 23 were discharged before being interviewed, 13 were too ill to be interviewed and eight did not give consent

- *Controls:* Seven declined to be interviewed
- *Age:* 52±11 years
- *Ethnicity:* Indian
- *Anthropometrics:* Cases had a significantly higher age, BMI, waist-to-hip ratio, alcohol intake and prevalence of history of hypertension, high cholesterol, diabetes and family history of IHD
- *Location:* New Dehli (northern) and Bangalore (southern), India.

Summary of Results:

Findings

Subjects had significantly lower intakes of green leafy vegetables and mustard oil and participated in less exercise than controls.

In conditional logistic regression analysis, increased total vegetable intake (not including potatoes) was significantly associated with a lower risk of IHD in the analysis adjusted for age, sex and smoking. In comparison with persons consuming a median of 0.8 servings per day, persons consuming 3.5 servings of vegetables per day had an RR of 0.27 (95% CI:0.11, 0.64; for trend, P=0.06).

Among the vegetables, the strongest associations were observed for green leafy vegetables, both in univariate and multivariate analysis. Persons consuming a median of 3.5 servings per week had an RR of 0.33 (95% CI: 0.17, 0.64; for trend, P=0.0001) compared with those consuming 0.5 servings per week.

Fruit intake was associated with an increase in risk (RR: 2.11; 95% *CI*: 1.03, 4.32; for trend, P=0.06), although this was not significant in the multivariate analysis, when comparing persons who consumed more than three serving per day with those who consumed one or less.

There was an inverse association between cereal intake and IHD risk in both univariate and multivariate-adjusted analyses, whereas beans and dairy foods were not significantly associated with risk of IHD in multivariate analyses. This effect with cereal intake was attributable to consumption of roti.

There was a suggestive trend of reduced risk with fish intake (RR: 0.69; 95% CI: 0.46, 1.03). An association with vegetarianism was not observed. About 38% of the subjects were vegetarian (no meat, chicken, fish, or eggs).

Persons adding vanaspati (hydrogenated vegetable oil) to foods were at slightly, but not significantly, higher risk of IHD than those who did not, with an RR of 1.81 in multivariate analysis (95% CI: 0.99, 3.31).

Compared with persons consuming sunflower oil, those using mustard oil for cooking had an RR of 0.44 for IHD in the age-, sex-, and smoking adjusted analysis. In multivariate analyses, use of mustard oil was associated with an RR of 0.49 (95% CI: 0.24, 0.99) compared with use of sunflower oil for cooking. Persons using mustard oil for frying foods had a 71% lower risk (RR: 0.29; 95% CI: 0.13, 0.64) in multivariate analysis. Use of mustard oil was associated with a two-fold lower risk than use of sunflower or other oils.

Author Conclusion:

Diets rich in vegetables and use of mustard oil, which is rich in alpha-linolenic acid, could contribute to the lower risk of IHD among Indians. The findings may be due to the low fish intake (0.07 servings per day) in this population.

Reviewer Comments:

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions		
1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	Yes
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	Yes

Validity Questions		
1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	**Were study groups comparable?**	Yes

3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	Yes
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	Yes
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	Yes
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	N/A
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	Yes
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	N/A
4.1.	Were follow-up methods described and the same for all groups?	N/A
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	N/A
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	N/A
4.4.	Were reasons for withdrawals similar across groups?	N/A
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	N/A
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	N/A
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	N/A
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A

6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	Yes
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	Yes
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	N/A
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes

	8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
	8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
	8.6.	Was clinical significance as well as statistical significance reported?	Yes
	8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**		Yes
	9.1.	Is there a discussion of findings?	Yes
	9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**		Yes
	10.1.	Were sources of funding and investigators' affiliations described?	Yes
	10.2.	Was the study free from apparent conflict of interest?	Yes